# ADDISON®

## SEQUENCE OF OPERATION FOR ALC CONTROL

### AIRSOURCE COOLING-ONLY
### 100% OUTSIDE AIR
### VERSION 2.0

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# SEQUENCE OF OPERATION

The **ALC** controller is turned on by a switch located on its front upper left corner. Several options exist for starting the unit, such as the Resident Program Scheduler or the Building Automation System. These control source options can be selected from the **BACview** display pad on the **Configuration Set-Up** screen (requires Admin password). The Resident Program has an adjustable scheduler that uses the internal time clock to allow for separate Sequences for Occupied and Unoccupied periods. This can be accessed from the **BACview** display pad on the **Schedules** screen (requires user password). **NOTE:** All temperature-related events have an additional "delay on make" to allow temperatures to settle.

### OCCUPIED MODE:

When the program control source calls for the start of the Occupied Mode, the **ALC** controller verifies that there are no fault or shutdown conditions, a delay timer begins after which the unit goes into Occupied Mode:

**1. Outdoor Air Damper (OD):**

- After the unit goes into Occupied Mode, the **OA** damper will open. As the **OA** damper opens, the Outdoor Air Damper Actuator **(OADA)** auxiliary switches close.

**2. Supply Fan (SF):**

- As the **OA** damper opens, the **OADA** auxiliary switch (adjustable) will close and the **SF** will turn on.
- The **SF** shall operate continuously while the unit is in the Occupied Mode. When the system reaches the end of the Occupied Mode period, the **SF** will continue to run for an additional **2** minutes before turning off.
- **SF-VFD:** Supply Fan Variable Frequency Drive.
  - The **SF-VFD** will modulate its speed based upon the differential pressure transmitter **(SF-DPT)** signal to maintain the supply duct static pressure set point.
  - For contact air volume **(CAV)**, select "Manual Override" in the **BACview** keypad and input the required speed **(Hz)** per field test and balance.

**3. Exhaust Fan (EF):**

- At the same time the **SF** turns on, the **EF**, if included, will turn on.
- The **EF** shall operate continuously while the unit is in the Occupied Mode. When the system reaches the end of the Occupied Mode period, the **EF** will continue to run for an additional **2** minutes before turning off.
- **EF-VFD:** Exhaust Fan Variable Frequency Drive.
  - The **EF-VFD** will modulate its speed based upon the differential pressure transmitter **(EF-DPT)** signal to maintain the building static pressure set point.
    For contact air volume **(CAV)**, select "Manual Override" in the **BACview** keypad and put the required speed **(Hz)** per field test and balance.

**4. Energy Conservation Wheel (ECW):**

- As the **OA** damper opens, the **OADA** auxiliary switch (fixed) closes which enables the **Johnson Controls C450** controller. At this point, the **wheel** operates as an independently controlled component. A separate **OAT** and **RAT** sensors are wired directly to the Johnson Control C450.
- **Wheel Standard Operation:**
  - When the **OAT** is above or below an adjustable differential **(3° F [1.7° C])** of the return air temperature **(RAT)**, the **Wheel** will be on, otherwise it is off.
- **Wheel with On/Off Defrost:**
  - When the **OAT** is above or below an adjustable differentia **(3° F [1.7° C])** of the return air temperature **(RAT)**, the **Wheel** will be on. It will be off if the **OAT** is within the differential range or below an adjustable set point to allow for wheel defrosting (default is **15° F [-9.4° C]**).
- **Wheel with VFD Controlled Defrost (WM-VFD):**
  - When the **OAT** is above or below an adjustable differential **(3° F [1.7° C])** of the return air temperature **(RAT)**, the **Whee**l will be on. It will slow its speed or stop if the **OAT** is below an adjustable set point to allow for defrosting default is **15° F (-9.4° C)**. It will be off if the **OAT** is within the **RAT** differential range.

**5. Cooling Mode:**

- When the Outdoor Air Temperature, **OAT** (Entering Coil Air Temperature, **ECAT**, if wheel exists) is above the leaving air temperature **(LAT)** cooling set point (**72° F [22.2° C]**, adjustable), compressor #1 turns on. When **OAT** (**ECAT**, if wheel exist) is 1° below the **LAT** set point, cooling modes is off.
- For systems with two compressors, when the **LAT** is above the **LAT** cooling set point plus an adjustable differential **(2° F [1.1° C])**, compressor #2 turns on.
- Compressor enabling logic includes a **4**-minute minimum run-time and a **5**-minute minimum time-off delay.
- **Digital Compressors:**
  - When unit has hot gas **Reheat**, the digital compressors will modulate (load and unload) based on the suction line temperature **(SLT)** set point (**45° F [7.2° C]**, adjustable).

- When unit has no hot gas **Reheat**, the digital compressor will modulate (load and unload) based on the leaving air temperature **(LAT)** cooling set point.
- If the **SLT** drops to **32° F (0.0° C)** or less, the digital compressor will run fixed at **10%**.
- For systems with two digital compressors, when there is a call for 1st stage cooling, 2nd stage cooling will also be enabled **10** seconds later. Both compressors will modulate to maintain the set point.

- For systems with two compressors, if there is a current call for 1st stage cooling and compressor #1 is shut down due to an alarm (**HP1**, **LP1**, or **SLT1**), compressor #2 will be turned on to take its place until it returns.
- **Hot Gas Reheat (HGRH) – On/Off:**
  - When the **LAT** is **1° F (0.6° C)** (adjustable) below the **LAT** cooling set point, **Reheat** turns on and cycles to maintain the **LAT** set point.
  - When the **LAT** is **2° F (1.1° C)** (adjustable) above the **LAT** cooling set point, **HGRH** turns off.

- **Hot Gas Reheat (HGRH) – Modulating:**
  - When the leaving air temperature is **1° F (0.6° C)** (adjustable) below the **LAT** cooling set point, **Reheat** turns on and modulates to maintain the **LAT** cooling set point.
  - When the **LAT** is **2° F (1.1° C)** (adjustable) above the **LAT** cooling set point, **Reheat** turns off.

**6. Dehumidification Mode:**

- When **OAT** (**ECAT**, if wheel exists) is more than **60° F (15.6° C)** and the zone relative humidity **(Z-RH)** is **1%RH** above the **Z-RH** set point, **55%RH** (adjustable) and there is no call for heating, Dehumidification Mode is enabled. After the minimum time-off delay, compressor #1 turns on.
- For systems with two compressors, when the **Z-RH** is **2%RH** (adjustable) above the **Z-RH** set point, after the minimum time-off delay, compressor #2 turns on. Both compressors will respond in sequence and run at full cooling.
- **Reheat** is enabled to operate as necessary to maintain the **LAT** cooling set point.
- When the **Z-RH** is **2%RH** (adjustable) below the **Z-RH** set point, the Dehumidification Mode is disabled.
- **Digital Compressors:**
  - The digital compressors run at **100%** capacity when there is a call for dehumidification.
  - During dehumidification mode, if the **SLT** drops to **38° F (3.3° C)** or less, the digital compressor will modulate from **100%** (for **SLT** of **38° F [3.3° C]**) down to **10%** (for **SLT** of **32° F (0.0° C**). Operation at **32° F (0.0° C)** or less will be the same as during normal cooling mode operation.
  - For systems with two digital compressors, both compressors will turn on and run at **100%** capacity.
- **Hot Gas Reheat (HGRH) – On/Off:**
  - When the **LAT** is below the **LAT** cooling set point, **Reheat** turns on and cycles to maintain the **LAT** set point.
  - When the **LAT** is **2° F (1.1° C)** (adjustable) above the **LAT** cooling set point, **HGRH** turns off.
- **Hot Gas Reheat (HGRH) – Modulating:**
  - When the **LAT** is below the **LAT** cooling set point, **Reheat** turns on and modulates to maintain the **LAT** cooling set point.
  - When the **LAT** is **2° F (1.1° C)** (adjustable) above the **LAT** cooling set point, **HGRH** turns off.

**7. Room Temperature Reheat Override (RTRHO) - Optional:**

- Room Temperature Reheat Override mode is selectable using the **BACview** display pad or **BAS**, and operates in cooling mode and dehumidification mode when **Reheat** is included (default is **"OFF"**).
- When **Reheat** is on and the zone air temperature **(ZAT)** is above the **ZAT** cooling set point, **72° F (22.2° C)** (adjustable), the **LAT** cooling set point will decrease by a ratio and decrease **Reheat** modulation (or turn off **Reheat**, if On/Off control) in order to lower the **ZAT**. When the **ZAT** equals the **ZAT** cooling set point, the unit will go back to normal cooling mode with **LAT** control.
- When the **ZAT** is below the **ZAT** cooling set point, the **LAT** cooling set point will increase by a ratio, turn on **Reheat** (if off), and increase **Reheat** modulation (if included) in order to raise the **ZAT**. When the **ZAT** equals the **ZAT** cooling set point, the unit will go back to normal cooling mode with **LAT** control.

**8. Heating Mode:**

- When the Outside Air Temperature, **OAT** (Entering Coil Air Temperature, **ECAT**, if wheel exists) is **1° F (0.6° C)** below the **OAT** (**ECAT**, if wheel exists) enabling heating set point, **55° F (12.8° C)** (adjustable), heating is enabled and modulates to maintain **LAT** heating set point, **72° F (22.2° C)** (adjustable).
- When the **OAT** (**ECAT**, if wheel exists) is **1° F (0.6° C)** (adjustable) above the **OAT** (**ECAT**, if wheel exists) enabling heating set point, heating is disabled.

**Staged Heat (Electric Heat or Gas Furnace):**

- **2-Stage Heat:** Terminal **W1** turning on enables first-stage heating. As the **LAT** goes further below the **LAT** heating set point, terminal **W2** energizes

and second-stage heating is enabled. As the **LAT** rises, second-stage heating turns off. As the **LAT** goes above the **LAT** heating set point, terminal **W1** turns off and first-stage heating turns off.

- **4-Stage Heat:** Terminal **W1** turning on enables the heating analog relay module **(HARM)** on the control panel which activates the different stages of heating. As the **LAT** goes further below the **LAT** heating set point, the different stages will turn on. As the **LAT** goes further above the **LAT** heating set point, the different stages will turn off.

- **Modulating Heat:**
  - **SCR Electric Heat:** On demand for heating, the electric heating **SCR** will modulate in order to maintain the **LAT** heating set point.
  - **Modulating Gas Heat:** On demand for heating, the gas furnace controller will modulate to control the gas flow in order to maintain the **LAT** heating set point.
- **Room Temperature Heating Override - Optional:**
  - Room Temperature Heating Override mode is selectable using the **BACview** display pad or **BAS**, and operates in heating mode when included (default is **"OFF"**).
  - When the zone air temperature **(ZAT)** is **2° F (1.1° C)** (adjustable) below the **ZAT** heating set point, the **LAT** heating set point will increase by a ratio and increase heat modulation in order to raise the ZAT. When the **ZAT** is equal to or more than the **ZAT** heating set point, the unit will go back to normal heating operation.
  - When the **ZAT** is **2° F (1.1° C)** (adjustable) above the **ZAT** heating set point, the **LAT** heating set point will decrease by a ratio and decrease heat modulation in order to lower the **ZAT.** When the **ZAT** is equal to or less than the **ZAT** heating set point, the unit will go back to normal heating operation.

### *UNOCCUPIED MODE:*

- When the system has reached the end of its Occupied Mode, the compressor(s) and outdoor fan(s) (subject to minimum run-time) or heating system will turn off. The **SF** and **EF** (if existing) will continue to run for **2** minutes before turning off. After this, the **Wheel** (if existing) will turn off and the **OA** damper will close.
- Unit is now off.

**Safety Switches:**

- **High Pressure Switch (HP):** If **HP1** is open, the **ALC** controller will issue an alarm and compressor #1 is turned off and locked out. After resetting **HP1**, the compressor lock-out can be reset in the **BACview** display pad or by cycling the power of the **ALC** controller.
- For systems with two compressors, this sequence is the same for compressor #2, **Y2** and **HP2**.
  **Low Pressure Switch (LP1):** If **LP1** is open after the **LP1** by-pass time, the **ALC** controller will issue an alarm and compressor #1 turns off. After **30** seconds (fixed), the **LP1** alarm will reset. Following a minimum time off delay, compressor #1 will turn on. If the **ALC** controller records **3** low pressure start/restart failure incidents within **1** hour, compressor #1 is locked out and the **ALC** controller will issue an alarm. The compressor lock-out can be reset in the **BACview** display pad or by cycling the power of the **ALC** controller.
- For systems with two compressors, this sequence is the same for compressor #2, **Y2** and **LP2**.

**Safety Shutdown:**

- **Smoke Detector:** When a smoke detector **(SD)** is provided, it is wired directly to the **ALC** controller. If smoke is detected, the **ALC** controller will shut down the unit. The alarm can be reset in the **BACview** display pad or by cycling the power of the **ALC** controller.
- If a compressor fails to start **3** times in an hour due to low pressure switch lock out. The alarm can be reset in the **BACview** display pad or by cycling the power of the **ALC** controller.
- If the **SLT** drops to **28° F (-2.2° C)** or less for **15** minutes, the **ALC** controller will issue an alarm and compressor stops. When the **SLT** warms back to **50° F (10.0 ° C)** or more, compressor turns back on. If a compressor fails to start **3** times in an hour due to low suction line temperature, compressor will be locked out. The alarm can be reset in the **BACview** display pad or by cycling the power of the **ALC** controller.
- If the **ALC** controller detects an **LAT** sensor failure. The alarm can be reset in the **BACview** display pad or by cycling the power of the **ALC** controller.

**Standard Alarms:** (alarms require reset in the BACview or cycling the power of the ALC controller unless noted)

1. **Supply Fan Alarm:** If the **SF** fails to start and the **SF-APS** (air proving switch) does not confirm air flow to **ALC**; following **60** second (adjustable) delay. Unit will automatically shut down.
2. **Exhaust Fan Alarm:** If the **EF** fails to start and the **EF-APS** (air proving switch) does not confirm air flow to **ALC**; following **60** second (adjustable) delay.
3. **Compressor #1/#2 Fault:** Compressor stops due to **HP1/HP2** open; following **30** second (fixed) delay. Requires **HP1/HP2** manual reset.
4. **Low Pressure Switch #1/#2 Alarm:** Compressor stops due to **LP1/LP2** open; following **90** second (adjustable) delay. Compressor lock out occurs if alarm happens **3** times in **1** hour **(Low Pressure Switch #1/#2 STOP)**.

5. **SLT #1/#2 Alarm:** Compressor stops due to **SLT1/ SLT2** freeze condition; following **15** minute (adjustable) delay. Compressor lock out occurs if alarm happens **3** times in **1** hour **(SLT #1/#2 STOP)**.
6. Sensors readings exceeding limits, following **2** minute (fixed) delay. Alarms reset automatically.
   a. **ECAT Sensor Failure** – if wheel exists; Open: **-60.2° F (-51.2° C)**, Short: **296° F (146.7° C)**.
   b. **EC-RH Sensor Failure** – if wheel exists; Open: **0%**, Short: > **100%**.
   c. **SLT1 Sensor Failure** – Open: **-60.2° F (-51.2° C)**, Short: **296° F (146.7° C)**.
   d. **SLT2 Sensor Failure** – Open: **-60.2° F (-51.2° C)**, Short: **296° F (146.7° C)**.
   e. **OAT Sensor Failure** – if no wheel exists; Open: **-60.2° F (-51.2° C)**, Short: **296° F (146.7° C)**.
   f. **OA-RH Sensor Failure** – if no wheel exists; Open: **0%**, Short: > **100%**.
   g. **ZAT Sensor Failure** – Open: < **45.1° F (7.3° C)**, Short: > **98° F (36.7° C)**.
   h. **Z-RH Sensor Failure** – Open: **0%**, Short: > **100%**.
7. **LAT Sensor Failure:** Open: **-60.2° F (-51.2° C)**, Short: **296° F (146.7° C)**. Unit will automatically shut down.
8. **High LAT Alarm: LAT** high limit, **120° F (48.9° C)** (adjustable) with Electric Heat. Alarm resets automatically.
9. **High LAT Alarm: LAT** high limit, **130° F (54.4° C)** (adjustable) with Gas Furnace Heat. Alarm resets automatically.
10. **Low LAT Alarm: LAT** low limit, **40° F (4.4° C)** (adjustable), following 15 minute (adjustable) delay. Unit will automatically shut down.
11. **Clogged Filter Alarm:** Clogged filter indicator **(CFI)**, following **2** minute (fixed) delay. Alarm resets automatically.
12. **Heat Failure:** In heating mode and the **LAT** falls below **50° F (10.0° C)** (adjustable), following **15** minute (adjustable) delay. Alarm resets automatically.
13. **Smoke Detector Alarm:** If smoke is detected, following **30** second (fixed) delay. Unit will automatically shut down.
14. **Set Point Overlap Alarm:** If **OAT** cooling and heating set points are selected such that the ranges overlap. Alarm logic will reset modified set points to previous value. Alarm resets automatically.

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**Installation Code and Quarterly Inspections:** All installation and service of ADDISON® equipment must be performed by a contractor qualified in the installation and service of equipment sold and supplied by Addison and conform to all requirements set forth in the ADDISON® manuals and all applicable governmental authorities pertaining to the installation, service, operation and labeling of the equipment. To help facilitate optimum performance and safety, Addison recommends that a qualified contractor conduct quarterly inspections of your ADDISON® equipment and perform service where necessary, using only replacement parts sold and supplied by Addison.

**Further Information:** Applications, engineering and detailed guidance on systems design, installation and equipment performance is available through ADDISON® representatives. Please contact us for any further information you may require, including the Installation, Operation and Service Manual.

**This product is not for residential use.**

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